

WHAT IS CLAIMED IS:

1. An electromagnetic drive type actuator
comprising:

a movable plate having a flat surface;

5 a support positioned around the movable plate;

an elastic member, which is elastically

deformable, connecting the movable plate with the
support, the elastic member supporting the movable

plate so as to allow the movable plate to move in
10 directions orthogonal to the flat surface of the
movable plate;

wirings, which carry currents, extending through
the support, the movable plate, and the elastic member;
and

15 magnetic field generating means for generating a
magnetic field in a space around the movable plate, the
magnetic field having a direction parallel to the flat
surface of the movable plate, so that the movable plate
is moved in the directions orthogonal to the flat
20 surface of the movable plate by a mutual effect between
the currents flowing through the wirings and the
magnetic field generated by the magnetic field
generating means.

2. The electromagnetic drive type actuator
25 according to claim 1, wherein the elastic member has a
mesh structure.

3. The electromagnetic drive type actuator

according to claim 1, wherein the elastic member comprises parts extending in two directions, which are not parallel to each other.

5 4. The electromagnetic drive type actuator according to claim 3, wherein the two non-parallel directions, along which the parts constituting the elastic member extend, are orthogonal to each other.

10 5. The electromagnetic drive type actuator according to claim 4, wherein the magnetic field has a direction of 45° with respect to the two directions, along which the parts constituting the elastic member extend and which are orthogonal to each other.

15 6. The electromagnetic drive type actuator according to claim 5, wherein the magnetic field generating means comprise two permanent magnets arranged on both sides of the movable plate.

 7. The electromagnetic drive type actuator according to claim 5, wherein the magnetic field generating means comprise electromagnets.

20 8. The electromagnet drive type actuator according to claim 1, wherein the elastic member comprises parts extending in a direction.

25 9. The electromagnetic drive type actuator according to claim 8, wherein the magnetic field has a direction orthogonal to the direction, along which the parts constituting the elastic member extend.

 10. The electromagnetic drive type actuator

according to claim 9, wherein the magnetic field generating means comprises two permanent magnets arranged on both sides of the movable plate.

11. The electromagnetic drive type actuator
5 according to claim 9, wherein the magnetic field generating means comprises electromagnets.

12. An electromagnetic drive type actuator comprising:

a movable plate having a flat surface;
10 a support positioned around the movable plate;
an elastic member, which is elastically deformable, connecting the movable plate with the support, the elastic member supporting the movable plate so as to allow the movable plate to move in
15 directions orthogonal to the flat surface of the movable plate and directions parallel to the same;
wirings, which carry currents, extending through the support, the movable plate, and the elastic member;
and
20 magnetic field generating means for generating a magnetic field in a space around the movable plate, the magnetic field being one of a first magnetic field having a direction parallel to the flat surface of the movable plate and a second magnetic field having a
25 direction orthogonal to the same, the magnetic field generating means selectively generating one of the first magnetic field and second magnetic field, so that

the movable plate is moved in the directions orthogonal to the flat surface of the movable plate or the directions parallel to the same by a mutual effect between the currents flowing through the wirings and the magnetic field generated by the magnetic field generating means.

13. The electromagnetic drive type actuator according to claim 12, wherein the elastic member has a mesh structure.

10 14. The electromagnetic drive type actuator according to claim 12, wherein the elastic member comprises parts extending in two directions which are not parallel to each other.

15 15. The electromagnetic drive type actuator according to claim 14, wherein the two non-parallel directions, along which the parts constituting the elastic member extend, are orthogonal to each other.

20 16. The electromagnetic drive type actuator according to claim 12, wherein the elastic member comprises parts extending in a direction.

25 17. The electromagnetic drive type actuator according to claim 12, wherein the magnetic field generating means comprises a first electromagnet that generates a first magnetic field, as necessary, and a second electromagnet that generates a second magnetic field, as necessary.

18. An electromagnetic drive type actuator

comprising:

a movable plate having a flat surface;

a support positioned around the movable plate;

an elastic member, which is elastically

5 deformable, connecting the movable plate with the support, the elastic member supporting the movable plate so as to allow the movable plate to move in directions orthogonal to the flat surface of the movable plate;

10 wirings, which carry currents, extending through the support, the movable plate, and the elastic member; and

a magnetic field generator, which generates a magnetic field in a space around the movable plate, the
15 magnetic field having a direction parallel to the flat surface of the movable plate, so that the movable plate is moved in the directions orthogonal to the flat surface of the movable plate by a mutual effect between the currents flowing through the wirings and the
20 magnetic field generated by the magnetic field generator.

19. The electromagnetic drive type actuator according to claim 18, wherein the elastic member has a mesh structure.

25 20. The electromagnetic drive type actuator according to claim 18, wherein the elastic member comprises parts extending in two directions, which are

not parallel to each other.

21. The electromagnetic drive type actuator according to claim 20, wherein the two non-parallel directions ,along which the parts constituting the elastic member extend, are orthogonal to each other.

22. The electromagnetic drive type actuator according to claim 21, wherein the magnetic field has a direction of 45° with respect to the two directions, along which the parts constituting the elastic member extend and which are orthogonal to each other.

23. The electromagnetic drive type actuator according to claim 18, wherein the elastic member comprises parts extending in a direction.

24. The electromagnetic drive type actuator according to claim 23, wherein the magnetic field has a direction orthogonal to the direction along, which the parts constituting the elastic member extend.

25. An electromagnetic drive type actuator comprising:

20 a movable plate having a flat surface;
 a support positioned around the movable plate;
 an elastic member, which is elastically deformable, connecting the movable plate with the support, the elastic member supporting the movable
25 plate so as to allow the movable plate to move in directions orthogonal to the flat surface of the movable plate and directions parallel to the same;

wirings, which carry currents, extending through the support, the movable plate, and the elastic member; and

5 a magnetic field generator, which generates a magnetic field in a space around the movable plate, the magnetic field being one of a first magnetic field having a direction parallel to the flat surface of the movable plate and a second magnetic field having a direction orthogonal to the same, the magnetic field
10 generator selectively generating one of the first magnetic field and second magnetic field, so that the movable plate is moved in the directions orthogonal to the flat surface of the movable plate or the directions parallel to the same by a mutual effect between the
15 currents flowing through the wirings and the magnetic field generated by the magnetic field generator.

26. The electromagnetic drive type actuator according to claim 25, wherein the elastic member has a mesh structure.

20 27. The electromagnetic drive type actuator according to claim 25, wherein the elastic member comprises parts extending in two directions, which are not parallel to each other.

25 28. The electromagnetic drive type actuator according to claim 27, wherein the two non-parallel directions along which the parts constituting the elastic member extend, are orthogonal to each other.

29. The electromagnetic drive type actuator according to claim 25, wherein the elastic member comprises parts extending in a direction.